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Educational Research Bulletin

(Registered in United States Patent Office)

Vol. VI SEPTEMBER 28, 1927 No. 13

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THE OHIO STATE UNIVERSITY
COLLEGE OF EDUCATION
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Published fortnightly, except during June, July, and August, with but one issue in December,
by the Bureau of Educational Research, Ohio State University.
Entered as Second-Class Matter, February 9, 1922, at the Post-Office at Columbus, Ohio, under the act of August 24, 1912.
Accepted for mailing at specified rates of postage provided for in Section 1103, Act of October 3, 1917,
authorized February 21, 1922.

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Educational Research Bulletin

THE ADDITIVE VERSUS THE TAKE-AWAY METHOD OF TEACHING THE SUBTRACTION FACTS

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The subtraction facts referred to in this article are the one hundred fundamental subtraction combinations. One of these facts is taught by the additive method when the answer is sought as the number which must be added to the subtrahend to produce the minuend. Consider, for example, the combination $\begin{array}{r} 7 \\ -5 \\ \hline \end{array}$. According to the additive method this is completed when the pupil thinks "5 and 2 are 7; write 2." On the other hand, a subtraction fact is taught by the take-away method when the answer is obtained as the amount left after reducing the minuend by the subtrahend. In the combination just noted, the form of expression may be "7 take away 5 are 2," "7 less 5 are 2," "7 minus 5 are 2"; or the subtrahend may be named first in the form "5 from 7 are 2." The purpose of the experiment here described was to find out which of these methods, the additive or the take-away, yielded greater accuracy of response.

In answer to an invitation in the autumn of 1925, a dozen or more teachers consented to work upon the experiment. Material which was reasonably usable was obtained from seven centers. In two instances, the pupils in two classes in the same grade and school were combined.

A condition which we wished to avoid was the utilization of pupils who had already been taught the subtraction combinations. Too often controlled experimentation intended to determine the better of two rival methods has been carried out with children to whom neither method was strictly applicable. If you want to find out whether a "together" or "separate" method of teaching addition and subtraction facts is better, you must obviously attack the question in a situation where the actual teaching of the appropriate subject-matter is undertaken.

In the present investigation, the experimental period was precisely coterminous with the teaching period. If the teacher was ready to begin the subtraction combinations in September, that was when the experiment began. If she was not ready until November, the experiment did not begin until November. On the other hand, the final examination which marked the conclusion of the experiment, was given when all the subtraction facts had been taught as far as initial teaching was concerned. This invariably took place in the spring—in March, April, or May.

For the purpose of grouping the children, the Pressey Primary Classification Test was given a little before the beginning of the experimental period. The teachers were directed to arrange the names of the pupils in the order of their scores in this test, pupil Number 1

having the highest score, pupil Number 2 the next, and so on. After this had been done, the teacher was ready to make up the groups. One of these groups was to be taught the subtraction facts by the take-away method; it was known as the "Take-away Group." The other group was to be taught the subtraction facts by the additive method, and it was called the "Additive Group." In the arrangement of pupils according to their scores on the intelligence test, pupil 1 was assigned, say, to the Take-away Group; pupils 2 and 3 to the Additive Group; pupils 4 and 5, to the Take-away Group; and so on.

When this had been done, each teacher had two groups of pupils which closely corresponded to each other in intelligence, according to this test. The groups not only had approximately the same mean intelligence but exhibited the same degree of variability. Moreover, each pupil in one group corresponded to a pupil in the other group who had substantially the same intelligence score. These two pupils were referred to as a "pair." For certain purposes, the study of the behavior on the final test of one member of a pair compared with that of the other member was illuminating.

The usual attempts were made to control the variables thought likely to affect the achievement of the pupils on the final test. The course of study was the same for the pupils in a given class. It was suggested that if possible no teaching other than that of the combinations be attempted during the experimental period. Realizing, however, that courses of study usually introduced such topics as measurement, counting, telling time, and the like, we stipulated that whatever additional teaching was done for one group should be done in precisely the same way for the other group.

Of course, the amount of time devoted each day to the teaching of arithmetic

TABLE I

THE RESULTS OF TEACHING SUBTRACTION FACTS AS AN ADDITIVE AND AS A TAKE-AWAY PROCESS AT CENTER NO. 1

PAIR NUMBER	PRELIMINARY TEST		FINAL TEST		DIFFERENCES IN FAVOR OF:	
	Additive Group	Take-away Group	Additive Group	Take-away Group	Additive Group	Take-away Group
(1)	(2)	(3)	(4)	(5)	(6)	(7)
One	64	64	97	98	.....	1
Two	63	61	56	82	.....	26
Three	61	57	55	99	.....	44
Four	60	56	79	93	.....	14
Five	55	52	33	82	.....	49
Six	53	52	99	97	2	.....
Seven	53	52	98	63	35	.....
Eight	52	50	77	55	22	.....
Nine	50	49	67	59	8	.....
Ten	49	48	96	59	37	.....
Eleven	48	46	17	94	.....	77
Twelve	46	41	30	23	7	.....
Thirteen	45	40	48	23	25	.....
Fourteen	41	38	13	74	.....	61
Fifteen	38	27	34	100	.....	66
Average	51.9	48.9	59.9	73.4		13.5

was the same for the two groups at each center, although not necessarily the same at different centers. Teachers were requested to alternate the time of the arithmetic periods. For example, the Additive Group might recite the first week at 10:10 while the Take-away Group might recite at 11:00. If this were the case, the Take-away Group was to recite the second week at 10:10 and the Additive Group at 11:00. The third week the first arrangement would again prevail. The drill and review work was to be done at school. No home work or outside study was to be expected or suggested.

The test given at the conclusion of the experiment was uniform. It consisted of the one hundred subtraction facts. In scoring this test the correct completion of each combination was given a score of "1"; the maximum obtainable score was 100.

Table I shows the results for the preliminary and final testing at Center No. 1. Each line represents a pair of pupils. The first line shows that, with respect to the first pair of pupils, the one who was taught additive subtraction obtained an intelligence-test score of 64; that the one who was taught subtraction by the take-away process, likewise obtained an intelligence-test score of 64; that the "additive" pupil got 97 of the one hundred subtraction facts right on the final examination; and that the "take-away" pupil got 98 of them right, thus securing an advantage of 1 point for the Take-away Group.

It will be noted that the pairing resulted in a slightly more capable Additive Group since that group averaged three points higher on the preliminary test than did the Take-away Group. We doubt, however, whether this has any real significance. So far as it has any, it would, of course, lead us to expect a slightly better final score for the Additive Group. The figures, however, indicate that, as far as averages are concerned, the Take-away Group came out ahead. The difference, amounting to 13.5 combinations correct, may be considered from the point of view of the usual reliability measures. The formula used for this purpose is:

$$PE_{\text{diff.}} = .6745\sqrt{\sigma_a^2 + \sigma_t^2 - 2r\,\sigma_a\,\sigma_t}.$$

In this formula r is the correlation between the scores of members of each pair on the final test. This r-value is very low, amounting here only to + .1; while σ_a, the standard error of the mean of the Additive Group, is 29.3 and σ_t, the standard error of the mean of the Take-away Group, is 25.1. Substituting these values in the formula we find that the probable error of the difference is 6.4. Thus, this difference, which as we have already seen is 13.5, is more than twice its probable error.

There are those who withhold their acceptance of a difference unless it is four times its probable error. Those who take this attitude generally fail to distinguish among the purposes of a difference. The determination of the significance of a difference depends quite as much upon the use you are going to make of it as upon the statistics by which it is derived. Merely to repeat uncritically the words of a textbook which in effect says that substantial certainty is only attained when the difference equals 4*PE*, and to refuse to consider small differences as having any practical meaning is to betray one's ignorance. The rules laid down in the textbook are derived from a theoretical application of the obtained difference and its probable error to the so-called normal surface of frequency.

Figure 1 is a representation of the theory in question, as it is applied to the difference, 13.5, and its probable error, 6.4. The chances are even that the true difference lies between 7.1 and 19.9, these being respectively 13.5 *less* 6.4 and 13.5 *plus* 6.4. This is graphically represented in the figure by the fact

that the area enclosed by the perpendiculars at 7.1 and 19.9 is one-half of the area under the entire curve. Furthermore, if we subtract another 6.4 from 13.5, getting 0.7, and if we add another 6.4 to 13.5 getting 26.3, we reach points such that if perpendiculars are erected at them, they will enclose 82 percent of the area under the entire curve. Accordingly, we say that the chances are 82 to 18 that the true difference lies between 0.7 and 26.3.

By the same line of reasoning, however, we are permitted to raise the whole question of reliability in this form: What are the chances that the difference will be in the *direction* obtained in the experiment in question? As applied to this particular experiment, the question would be: What are the chances that the true difference will favor teaching the subtraction facts by the take-away rather than the additive method? In Figure 1, the zero point is at $-2.1PE$. We learn from the well-known tables of the normal surface of frequency that, between the mean ordinate and $2.1PE$, 42 percent of the area under the curve may be found. This is shown by the shaded portion of Figure 1. Accordingly, the chances are 42 in 100 that the true difference in favor of teaching take-away subtraction is between 0 and 13.5. In addition to this, however, we have the entire right half of the curve amounting to 50 percent of this area; and all the differences greater than 13.5 correspond to this area. In other words, there are in addition to the 42 chances in 100 already mentioned, 50 more chances that the difference will favor take-away subtraction. According to the current theory of the reliability of a difference, the data obtained at Center No. 1 justify us in expecting similar experiments to turn out in favor of take-away subtraction 92 times out of 100 or roughly 9 times out of 10.

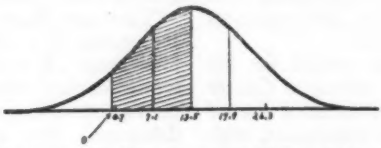

FIGURE 1. To illustrate the reliability technique

For our own part we are by no means satisfied with the adequacy of the customary reliability formulae. But those who insist upon the application of these formulae will do well to realize where they lead and what they mean—granting the assumptions at the basis of them—in concrete situations.

But we are getting away from our story. At Center No. 2 owing to the absences of pupils at one time or another, only 11 pairs were available for the purposes of our study. The average performance of the Additive Group at this center was 59.4 examples right. The similar figure for the Take-away Group was 72.2. The difference, amounting to 12.8, has a probable error of 9.8. According to the theory of the reliability technique, this means that the chances are 81 to 19, or about 4 to 1, that the difference would favor the Take-away Group if the experiment were repeated under like conditions.

Table II presents a summary of the results obtained at the seven centers. The reader will note that among these seven centers only one returned a verdict in favor of teaching the subtraction combinations by the additive method. There

was no apparent reason why there should be an exception here, nor is it profitable to attempt to explain it. Indeed, there is every reason to suppose that even if in general the take-away method is to be preferred there will be, on the basis of chance, occasional returns favorable to the additive method.

All the differences in favor of the take-away method exceed their probable errors, and therefore the chances are always better than 75 to 25 (see Figure 1) that true differences will be in the direction of those obtained. The significance of the figures, however, lies not in the size of the differences nor in the relation of these differences to their own probable errors, but rather in the all but unanimous verdict in favor of one of the two methods of teaching the subtraction facts. Practical people confronted by a six-to-one vote will regard the question as rather definitely settled.

Yet we must not go beyond the conditions to which the figures refer. Essentially, they have to do with the immediate recall of the specific number facts. They do not tell us anything about the efficiency of either method in respect to retention; nor do they tell us anything about the superiority of either of these methods when children have to use the fundamental combinations in different situations, such as problem work and the subtraction of large numbers.

We have learned, however, from other sources that retention tends to vary in strength with the fidelity of initial learning. Furthermore, we have fairly good reason to suppose that the use to which knowledge of number combinations may be put increases with the adequacy of that knowledge. Therefore, without regarding the extension of our conclusions as certain, we may, in the absence of evidence to the contrary, presume that the method which secures better immediate results will likewise secure better results when tried in new situations. In any event, for what these data may be worth, they are submitted as evidence on the vexed question of method in teaching subtraction.

TABLE II

GENERAL SUMMARY

Center	Number of Pairs of Pupils	Average in Final Test		Differences in Favor of:		Probable Error of Difference
		Additive Group	Take-away Group	Additive Group	Take-away Group	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
One	15	59.9	73.4	.....	13.5	6.4
Two	11	59.4	72.2	.....	12.8	9.8
Three	17	42.8	51.0	.....	8.2	5.3
Four	24	73.3	65.0	8.3	.....	4.0
Five	29	63.9	71.1	.....	7.2	3.8
Six	5	56.0	64.4	.....	8.4	5.4
Seven	9	68.1	78.1	.....	10.0	7.4

The Ohio Teachers' Reading Circle books for the 1927-28 course were adopted by the Board of Control April 7. The books adopted were: *Principles and Technique of Teaching*, by F. W. Thomas, author of *Training for Effective Study* which was on the 1925-26 list; *Teaching Arithmetic in the Intermediate Grades*, by R. L. Morton; *Europe since 1870*, by E. R. Turner; *Self-Help Methods of Teaching English*, by J. H. Wohlfarth; *Elementary School Supervision*, by A. S. Gist; *Education for Character*, by D. L. Sharp; and *Literature in the Schools*, by M. A. Dogherty.

ANALYSES OF THREE THOUSAND ILLEGIBILITIES IN THE HANDWRITING OF CHILDREN AND OF ADULTS

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AND
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SEVERAL years ago one of the writers, while reading Ayres' monograph on his first writing scale, became interested in certain observations made by Dr. Ayres regarding factors which affect the legibility but not the appearance of handwriting. He said that breaks between syllables within a word might interfere distinctly with reading, since readers at first glance failed to distinguish syllabic divisions from divisions between words, although such breaks might not at all interfere with the good appearance of writing.

These remarks of Dr. Ayres seem to have been somewhat of an aside, and they also seem to have attracted little attention from others. In the opinion of the writers, these statements suggested an approach to the problems of handwriting quite different from that commonly made and one which seemed pragmatically sound. Since the primary purpose of handwriting is that it be legible but not necessarily decorative or attractive in appearance, it would seem highly desirable to determine analytically the factors which interfere with reading. When these factors have been determined, a diagnosis of faults in handwriting may be made, and instruction in the subject may then be directed with reference to the characteristics definitely known to interfere with legibility.

This paper briefly reports an approach of this sort to the problems of handwriting. The purpose was to determine the malformations, and the particular letters most commonly involved therein, which interfere with reading and to discover the comparative frequency with which each form appears. Based upon these data, it was hoped also that a procedure might be developed by which a teacher might readily analyze the work of a given pupil or class and direct her instructional efforts toward those letter formations which should be avoided if the handwriting was to be pragmatically most effective.

MATERIALS AND METHODS

The information given in this report was gathered from about 300 papers of children in Grades III–VI from three different schools in two school systems, 150 papers from pupils of Grades VII-VIII of a junior high school, and approximately two hundred papers from college students.[1] The specimens from the public-school pupils included papers prepared in English classes and examination papers in history and geography. The junior high-school papers were final examinations; those of the college students were special reports and examinations. These papers were allotted to sixteen graduate and advanced undergraduate students in a laboratory course in educational diagnosis.

The students worked on papers from all three levels. They were asked to read the papers they were given and to mark any letters or combinations of letters which caused them difficulty. That is, if they had to look twice at a word, they were to check that part of the word which gave them trouble. They were also to note on each paper any

[1]The exact number cannot be given since three or four of the slow readers did not quite finish the allotment of papers given them.

TABLE I

ANALYSIS OF TWO THOUSAND SEVEN HUNDRED THIRTY-SIX ILLEGIBILITIES

Letter	Different Forms	Total Illegibilities	Letter	Different Forms	Total Illegibilities
(1)	(2)	(3)	(1)	(2)	(3)
a	14	198	p	11	34
b	12	75	q	1	1
c	14	105	r	18	336
d	12	167	s	12	147
e	14	206	t	11	148
f	8	65	u	19	74
g	8	58	v	8	51
h	15	134	w	14	64
i	10	101	x	4	8
j	2	4	y	9	22
k	4	30	z	2	4
l	12	76	D*	3	12
m	12	69	I	12	51
n	11	230	T	2	11
o	13	172	Other capitals	42	82

*Only those capitals are listed which show total illegibilities of 10 or more.

general characteristics, such as erasures, writing over, dropping of loops of y and g into the line below, which interfered with reading.

With the aid of Mr. Skeels, supervisor of writing in the Columbus public schools, a chart was prepared listing various malformations which might interfere with reading. This tentative chart was mimeographed with spaces for additions under each letter; and the students—after they had finished their reading—were asked to classify and tabulate the illegibilities they had marked. The classification within this chart was tentative, and the readers were free to add new types of errors or reclassify them in any way which seemed better. As a matter of fact the readers more than doubled the list of errors.

THE RESULTS

The results were then combined and a final scheme of errors arranged. Briefly it may be said that the students located a total of 2,736 specific illegibilities and mentioned general characteristics, which interfere with reading 284 times. Twenty different classes of these characteristics were listed. Those which caused most difficulty were determined by the frequency of mention. In the following table those characteristic illegibilities which were mentioned more than 8 times—3 percent of 284, the total number—are listed:

	Percent
Words crowded	20
Too angular	15
Re-writing	13
Breaks between letters	13
Loops too long	10
Letters crowded	7
Poor spelling	5
Crowding at side of paper	5
Miscellaneous	12
Total	100

The findings presumably need no comment; the practical conclusions for instruction in handwriting are obvious. The specific faults, which will be mentioned later, may be more valuable to the teacher, however.

One naturally comes next to the question, "Which letters of the alphabet cause most trouble?" Table I summarizes the data gathered from the papers here considered. The capitals give little trouble—probably because they do not occur so frequently as the small

letters. The only capital which gives much trouble is *I*. When the small (lower case) letters are compared, it is seen that the most troublesome letter is *r*, whose total, 336, is 12 percent of all the specified illegibilities. The next in frequency is *n*. In fact, the six small letters *r*, *n*, *e*, *a*, *d*, and *o* account roughly for one-half of all the illegibilities. The inference naturally suggested is that, by proper emphasis in teaching the formation of the few most troublesome letters, marked improvement in "read-ability" might be easily brought about.

TABLE II

DISTRIBUTION OF THE FREQUENCIES OF DIFFERENT MALFORMATIONS

Number of Occurrences	Small Letters	Capital Letters	Total
(1)	(2)	(3)	(4)
80–100	4	.....	4
75– 79	2	.....	2
30– 74	4	.....	4
25– 29	13	.....	13
20– 24	8	.....	8
15– 19	10	1	11
10– 14	19	2	21
5– 9	45	6	51
4	15	5	20
3	19	4	23
2	33	8	41
1	98	33	131
Total	270	59	329

The analysis of specific malformations is of chief interest. Table II shows the number of malformations which had certain frequencies of appearance. Thus, malformations of 4 small letters were mentioned 100 times or more. This table clearly shows that a few such errors accounted for the great mass of illegibilities. Of the 329 illegibilities listed, 131 occurred only once,[1] while 4 appear 100 times or more, and 63 appeared ten or more times. These 63 account, however, for over three-fourths of all the specific illegibilities.

These 63 errors, which may serve the classroom teacher as a suggestion for an analysis chart, are summarized in the open table which follows:

a like *u* 30
a like *o* 24
a like *ci* 7

b like *li* 8
b like *l* 5
b like *k* 4
b like *f* 4

c like *e* 18
c like *i* 12
c like *a* 4

d like *cl* 41
d like *l* 5
d like *a* 4

e closed 52
e too high 7
e like *c* 5

f like *oj* 5
f like *b* 5

g like *y* 13

h like *li* 19
h like *p* 9
h like *b* 7
h like *l* 7

i like *e* 10
dot right 10
dot left 10
no dot 4

k like *h* 8

l uncrossed *t* 10
l too short 8

m like *w* 14

n like *u* 59
n like *v* 11
n like *s* 5

o like *a* 34
o like *r* 8
o closed 6
o like *u* 5

r like *i* 59
r too small 5
r like *s* 13
r like half *n* 13
r like *u* 8
r like *e* 4

s indistinct 26
s like *r* 10
s like *i* 5
s like *o* 4

t like *l* 19
cross above 11
no cross 7
cross right 6
cross left 5

u like *ni* 4
ur like *w* 4

v like *n* 6
v like *r* 4

w like *u* 8
w like *m* 4
wr like *ur* 4

D not closed 4
I like *cl* 8
T like *L* 4

Miscellaneous small letters 205
Miscellaneous capitals 41

The errors which appeared ten times or more are given after each letter and are arranged in the order of the frequency of occurrence. The figures indicate the frequency per 1000 malformations because the frequency per 100 illegibilities, or the percent which each form contributed to the total of all illegibilities, was thought to be inadequate for the purpose.

Most of these errors will at once be recognized as familiar trouble-makers. It is evident that some are outstandingly important. Five forms, *n* like *u*, *r* like *i*, *e* closed, *d* like *cl*, *o* like *a*, account for a

[1] Many of these were pairs of letters which in combination caused trouble and might perhaps better have been analyzed; but, since the readers saw the combination as one problem, it was so carried in the tables.

quarter of the total. Instruction directed simply against those five forms might thus be expected appreciably to improve legibility.

VALUES OF THESE FINDINGS

What are the important values of the data presented in the preceding sections? Several points might be mentioned, but three seem especially worthy of consideration. A field of research is indicated in which there appears a variety of problems of decided interest. Variations in type of error in relation to age deserve careful study. The present investigation showed sufficient similarity between the errors made by the pupils of the graded schools and the college students to justify the lumping of results for the purposes of this paper. For example, of the 10 illegible forms most common in the children's writing 8 were among the most common 10 for the college students. However, such errors as *d* like *cl* and *a* like *u* were more commonly made by the children, while such forms as *n* like *u* and *h* like *li* were more frequent in the writing of college students. It would seem particularly desirable to study writing of beginners to see whether the development of the common illegibilities might not be prevented. A comparison of different systems and methods of teaching handwriting in regard to the extent to which they prevent illegibilities would also seem desirable.[1]

The study also suggests a somewhat new point of view for instruction in handwriting. That is that specific features affecting legibility, rather than characteristics making for charm of appearance, should be the major consideration. Attention would then presumably shift from emphasis on general form, slant, and smoothness of stroke to stress an avoidance of *d* made like *cl*, *r* like *i*, *g* like *y*. As a result of such a direct attack upon the practical problem, it seems reasonable to conclude that such a shift in emphasis might result in modifications of instructional method with distinct gains in effectiveness.

Moreover, the investigation opens up a new approach to problems of measurement and diagnosis in handwriting. A diagnostic chart prepared by the writers on the basis of this work will, by contrast with the usual chart dealing with such factors as alignment or quality of line without reference to legibility, make clear the distinctiveness of this approach. It includes all the general and specific errors listed in this report and provides a column for the record of each child in the class. It is thus easily possible to find not only the number of illegibilities appearing in the work of the class as a whole and the errors most common, but also to determine just what illegible forms each child makes and to locate his particular outstanding difficulties. With the situation thus mapped out before her, the teacher is admirably informed as to what needs to be done to improve the legibility of each pupil's written work. Evidence recently gathered indicates that difficulties in deciphering the writing of the average individual are due primarily to a few confusing forms which the individual makes over and over again. Effort in teaching concentrated upon these few recurring difficulties should, then, result in rapid improvement. Briefly, it may be said that an experiment, carried on with a group of fourth-grade children with six weeks of individualized drill based on such analyses, resulted in such gains in legibility that 50 percent more words, written by these children, could be read per minute after the experiment than before. There were gains in speed and quality as measured by the Ayres Gettysburg Scale which were greater than those made by a control group which simply had the usual class work in writing.

(*Continued on page 285*)

[1] It might be mentioned that most of the elementary-school papers came from schools using the Natural System.

Ohio State University
Educational Research Bulletin

Published fortnightly, except during June, July, and August, with but one issue in December, for the schools of Ohio by the Bureau of Educational Research, College of Education, The Ohio State University, Columbus.

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EDUCATIONAL RESEARCH AND EDUCATIONAL PRACTICE

SOME time ago I was introduced to a surgeon of more than local reputation. After a few minutes of general conversation he turned to me with the question, "What is your line of work?" I replied, "Educational research." A puzzled look came over his face and he said, "I understand what research is in surgery and medicine, but I do not believe I know what it is in education. Research is a very interesting field and I have done quite a bit of it myself." He then launched into a detailed account of a particular piece of research on which he had been engaged for several years. At the conclusion of the story he came back again with the question, "What is research in education?"

"The purpose," I replied, "is the same as in medicine and surgery, the search for new truths, the improvement of ways to do things. The field of education is very large. We are concerned not only with what should be taught, but how to teach it, when it should be taught, what degrees of skill should be attained, and the various other phases of education. Each of these phases contains innumerable problems. We are no longer so certain as we were at one time that we know what to teach or how to teach it. We are raising definite questions and submitting them to experimental technique. In the field of spelling, for example, a number of research workers have sought to ascertain what words are used by children in spontaneous writing, what words are used by both children and adults in letters, and what types of writing are used by most people in life situations. We are working to find the vocabulary for which there is the greatest assurance that each child who goes through the schools will have a need.

"In reading we are seeking for more efficient ways of teaching to develop skill in both rate and comprehension. In arithmetic we wish to know the best way of presenting certain materials which, on the basis of an analysis of life activities, have been found to be used very frequently. We need to know whether there are definite differences in the way children of different degrees of mentality learn. We are seeking to discover inherent difficulty in various bits of subject-matter and what causes that difficulty. In other words, we are questioning today every procedure which we have used in the past and every type of material which has been handed down to us; and we are asking for scientific evidence regarding the value of the material and the efficiency of the procedure."

The surgeon manifested keen interest in this brief explanation of the meaning of educational research. He, like most others who have not been closely associated with the progress that has been made in the scientific treatment of educational problems, was quite unaware of the extent to which efforts are being made to improve practice and verify opinions. Even teachers and school administrators who have not followed the literature closely are not fully cognizant of the problems that are being attacked in laboratories and demonstration schools. They also fail to see the relation which they themselves sustain to the problems of research and the contribution which they can make.

A great many of the problems of learning must be worked out in laboratories or in classrooms under carefully controlled experimental conditions. The validity of the findings under these conditions with respect to schoolroom practice must be proved by regular teachers in regular classroom situations. Every classroom teacher and every school administrator may make a definite contribution to this phase of research. We need to know the extent to which laboratory results hold true in normal classroom situations and the extent to which regular classroom teachers can utilize the findings of the laboratory. We need to know the extent to which administrative practices which are theoretically desirable are practically feasible, and only superintendents and principals who have tried these practices can answer these questions.

A great many of the readers of this Bulletin attended summer school this past summer. In courses in school administration, principles of teaching, and psychology, new evidences on old problems were presented. New ways of presenting material, new theories regarding selection and organization of subject-matter, suggestions on administrative and supervisory practice were expounded by those who had either conducted research themselves or had carefully studied the record of research done by others. The question may well be raised whether the new ideas received in these summer-school courses are going to modify our practice during the current school year. If we do not use any of the new things we have learned, how can they affect our students or our school organization? Furthermore, if teachers, principals, and superintendents in regular positions do not attempt to apply the findings of research, research workers are deprived of the best means of knowing the validity of their findings. The regular workers in the public school can make as great a contribution to the progress of education by careful efforts at applying the results of educational research as by doing what is ordinarily called by that name.

The greatest deterrents to better teaching are not autocratic administrators, poor classroom conditions, or dull children. The greatest deterrent to better administration is neither restrictive legislation nor oppressive regulations by the state department, neither a backward community nor untrained teachers. The greatest deterrents are likely to lie within ourselves, and are passive acceptance of the traditional and unfamiliarity with new theories, new evidences, new procedures published in our educational journals. We are too prone to continue in our accustomed ways rather than to try out the new. Educational practice lags behind educational theory and knowledge just as health practice lags behind medical knowledge. The vital question to each of us, however, is not what is the condition in general, but what is the condition in my own class or school? What influence are summer school and educational journals having in modifying classroom procedure and administrative practice in my community?

E. J. A.

The following letter was occasioned by an article in the Bulletin:

MY DEAR DR. BUCKINGHAM:

I am inclosing a bulletin sent out to the elementary teachers of the first four grades, which recognizes, I think, some of the ideas expressed in your article in the EDUCATIONAL RESEARCH BULLETIN of January 5. I have believed for many years that the computing phase of number work is specific learning of the simplest form, a situation-response act.

I have heard teachers say to pupils who have made errors in computing, "You must *think* what you are doing," but I do not believe that "computing" is a thinking process, but just a "doing" process.

When I was a boy, we had an old, blind, sorrel mare that would back out of her stall, go out of the stable, cross the barnyard diagonally, pass through

a gate, cross the lane, through another gate, up the path to the pump, get a drink, and return and enter her own stall. She was quite an old mare, had lived in the same barn for years, and passed through the same gates many times. If any obstacle should interfere with her movements, she would be lost until returned to her starting point in the stable. Had that sorrel mare been born a red-headed girl, she would have learned addition, multiplication, in much the same way.

But I do not want to bore you. I just want to express my appreciation of your article, "Arithmetic at the Crossroads."

Very truly yours,

A. H. DOUGLAS

Butte, Montana *Superintendent of Schools*

The Research Department of the Colorado State Teachers College, at the request of the Colorado Research Foundation, has rendered a valuable service to the state through its study of the provisions that Colorado is making for secondary education. The preliminary report, issued in May, 1926, reviewed the vocational and educational plans of 4,056 eighth-grade children in eleven representative counties of the state. The second report[1] is concerned with the extent to which the school districts of the state have established high schools, the extent to which districts not having their own high schools pay tuition in other districts and the ability of these districts to make such provision, past and present legislation with respect to tuition in Colorado, present legislation in other states with respect to payment of tuition, and suggested remedial legislation for Colorado so that high-school privileges might be afforded properly qualified pupils in all districts.

That deprivation of such privileges exists in a large degree is evident from the mass of data presented. For example, the report states that approximately one hundred and twenty thousand, or 35 percent, of the pupils of the state representing 50 percent of the state's area are without high-school privileges. Furthermore, it is found that approximately twenty thousand, or 17 percent, of the pupils of the state are without district aid for needed high-school tuition. In fifty-four out of sixty-three counties, 80 percent of the districts are without high schools, and 15 percent of these districts make no provision for outside tuition. The refusal to pay outside tuition is confined to third-class districts, although more than a fourth of the second-class districts are without their own high schools.

These conditions are partially due to "permissive" legislation; two previous laws making payment of tuition mandatory have been held unconstitutional by the State Supreme Court. A proposed mandatory high-school tuition law is included in the last part of this report, but, it is pointed out, before any such law can be made mandatory, an amendment to the present state constitution will be necessary.

PROJECTS OF THE BUREAU OF EDUCATIONAL RESEARCH FOR 1927–28

IN accordance with our custom, we are announcing the projects of the Bureau of Educational Research, Ohio State University, for the coming year. Some of the projects previously listed on the program of the Bureau have been completed, others have been dropped because preliminary work has shown them not feasible at the present time. Those which remain will be included in the list for the coming year. The projects which are carried forward from previous years will retain the numbers by which they have been designated

[1] *The Legal Basis of Free Secondary Education in Colorado.* Second Report of Progress in the State High-School Survey for the Colorado Research Foundation. Greeley, Colorado, Colorado State Teachers College, Department of Educational Research, 1926. 65 pp. (Mimeographed)

Numbers which were assigned to completed or discarded projects will of necessity be given to new projects; care must be taken, therefore, not to confuse the old numbers with the new. The cooperation and assistance in the investigation of any of these projects are solicited not only from the schools of Ohio but from the schools of other states as well.

Project 1. Class-size and teaching load.—The investigations of the effect of the size of class which have been made previously in various types of schools have been concerned with the class as the unit of comparison. Another factor which seems to warrant further study of this problem is the teaching load. The relative success of a teacher who has one large and one small class may be judged differently when compared with the results obtained by a teacher who has several large or several small classes. The purpose of this project is to compare the results of junior and senior high-school teachers who carry heavy teaching loads one semester and light teaching loads during the second semester. The study will be best organized when two teachers in the same department will form a team for the investigation of the problem. These teachers should have similar schedules: one should have four or five large classes the first semester, and the other one a similar number of small classes. The conditions should be reversed during the second semester.

Project 2. The inherent difficulty of learning to spell certain words.—The difficulty of words as expressed in our spelling scales has been determined by the accuracy with which children spell words under given conditions without any information regarding the time or effort expended in the learning. In order to get some information regarding the inherent difficulty of learning, a tablet has been devised which provides a stub upon which can be recorded the number of times a word is misspelled during a specified procedure. This procedure calls for a test on all words on Monday, Wednesday, and Friday of the week in which the word occurs in the regular lesson and review testing on Wednesday and Friday of the fourth week thereafter. On Tuesday and Thursday of the week in which the words are met for the first time each child is expected to study the words which were met on the preceding day according to a prescribed method. In like manner, on Thursday of the review week the words missed on the day before are studied. It is felt that words which are still missed after specific study on two or more occasions are inherently more difficult to learn than those which are mastered at once. These tablets have been used by a considerable number of children in each grade, and the stubs carefully filled in and kept. An analysis of these data is now under way.

Project 3. Teacher personnel problems.—This is the second year for this study which is going forward under the direction of J. A. Baer guided by Dr. Ashbaugh. During the past year statistics showing the number and percents of men teachers in the public schools have been collected. More than three hundred men who have gone out of the teaching profession have responded to an inquiry concerning their preparation for teaching, their reasons for leaving, their attitudes toward the profession, and their present sorts of work. Six hundred men and women who are now teaching have given information concerning salary, training, experience, subjects taught, teaching load, extra-curricular activities, number of dependents, and professional and community responsibilities. These data are being analyzed to find the activities in which each sex engages in contrast to the other. Other types of information will be secured, all of which will attempt to show more clearly, than has been done in the past, the factors which affect the personnel of teachers. Up to the present time

there has been much expression of opinion and prejudice but relatively little data with respect to the sex factor in this problem.

Project 4. A short method of evaluating test material.—From the beginning of the research movement in America, not a few leaders have insisted that the accumulation of scaled data should be the business of bureaus and other organizations devoted to educational inquiry. This means that questions, problems, words, and other elements which may enter into tests both of ability and of achievement should be evaluated for difficulty. The difficulty of an element is taken to be a function of the percent of people who react successfully to it.

The task of ascertaining the difficulty of test items is most laborious if one is going to do the work with a satisfactory degree of reliability. We have been experimenting with a short method of determining the difficulty of words to spell. During the coming year we wish to continue this investigation. It now appears that for all but the most accurate and scientific purposes, a method may be made available which is considerably shorter than any now in use. The method though applied to spelling words is equally applicable to any other item or element of a test such as examples or problems in arithmetic; questions in geography, history, or grammar; multiple-choice responses, and similar elements used in intelligence testing.

Project 5. Curricular offerings in the high schools of Ohio.—While it is generally well known that pupils in small schools are restricted to narrower curricula than pupils in large schools, there is little definitely known regarding the courses in schools of various sizes and the relation which size bears to the curriculum. This is affected in any school by at least two factors, finance and the prevailing philosophy of education. The former is usually recognized as a more definite factor than the latter. Yet everyone who determines what shall be offered in the curriculum does so consciously or unconsciously on the basis of the attainment of goals which are considered desirable. A blank soon will be sent to the administrative officers of each high school in the state asking for cetain data pertaining to the situation during the present school year. A knowledge of the existing conditions should throw much light on the subjects which the administrative officers feel must be given under the present financial conditions.

Project 6. Research problems in arithmetic.—It is our desire in this connection to continue some of the arithmetic projects in which we engaged last year as well as to set up some new ones. The following problems have already been investigated to some extent and will be continued under favorable conditions: (1) adding upward versus adding downward; (2) subtraction as a take-away or an additive process; (3) teaching the addition and subtraction combinations together or separately; (4) borrowing versus equal addition in the subtraction process; (5) teaching the multiplication and division combinations together or separately; (6) teaching division by a one-place number according to the short or long process.

New arithmetic projects to which we invite attention are:

1. The effect of short and frequent drill periods both oral and written.
2. The value of games in teaching primary arithmetic.
3. The value of requiring children to check their work in arithmetic.
4. The function of problems without numbers in learning to solve problems.
5. An attempt to determine the arithmetic which children know when they enter school.
6. The elements in verbal problems which make them hard to do.

7. Subject-matter and method in teaching children to solve verbal problems.
8. The value of illustrations in the solution of verbal problems.
9. Present mooted issues or open questions concerning the teaching of arithmetic.
10. The preparation of teachers of arithmetic.
11. What to teach in arithmetic.
12. The composing of problems.

Project 7. Junior and senior high-school English.—This project has been under way for a year and approximately fifteen hundred letters have been collected which were written by junior and senior high-school students to their relatives and friends and sent through the mail. A larger number of letters for certain grades and ages is desired to make the findings significant. The number of letters written by boys also is smaller than it was hoped to obtain. The cooperation of the school people of the country is most earnestly solicited in securing additional letters. If superintendents and principals who are interested will either ask their students directly or have their English teachers make the request, a large number of such letters may be secured. No publicity will be given to the letters. Indeed, the names of the writer or receiver may be blotted out if desired. Only letters written by persons of junior or senior high-school rank and mailed directly to their friends are wanted. Each person contributing one or more letters should mark plainly on each letter the sex, age, and school grade of the person who wrote the letter.

Project 8. Classroom visiting.—One of the large items in connection with supervision, as supervision is usually exercised, is observation of the teacher at work. There is doubtless a good and a bad way of doing this. This project will address itself to the establishment of the good way. When one comes to analyze the practice of supervisors, one is astonished to find the diversity, as well as the lack, of method found in classroom visiting. This project will be largely a study of cases.

Project 9. Teachers' meetings.—One of the recognized means both of supervision and of in-service training is the teachers' meeting. As in the case of classroom visiting, some procedures are good and others are not so good. This project proposes to inquire into the characteristics of the best teachers' meetings with a view to setting up for the benefit of all experiences of the most successful few.

Project 10. Comparison of efficiency of large and small school units.—The current expenditures per pupil in small school units of all types are considerably in excess of those of large units. In a recent study of operating costs, it was found that schools having enrollments of less than 100 pupils cost as much as 37 percent more per pupil than those enrolling 500 or more. On the basis of this fact certain small units were abandoned although the progress of the pupils in the smaller schools may have warranted the additional expenditure. In this study small and large school units in both small and large communities will be compared on the basis of pupil progress in an effort to determine the instructional efficiency of school units of different sizes.

Project 11. Relation of pupil achievement to money expended for supervision.—Pupil achievement was recently compared with current expenditures per pupil—intelligence being held constant—and no significant relation was found in any of the five groups of cities considered. The results of this study may have been somewhat vitiated by the inclusion of certain items of expenditure which did not contribute to instruction. In this project, the expenditure for supervision, a function whose only reason for existence is to produce better instruction will be related to pupil achievement in

an effort to ascertain the results which might accrue from further expenditures in that field.

Project 12. The depreciation rate on school buildings.—The business man has long considered an annual depreciation charge on the physical plant a legitimate charge. School authorities are now beginning to regard certain phases of the operation of the public schools in the light of a business enterprise and have therefore adopted, among other commercial procedures, the depreciation charge on the school plant. In order to arrive at the annual rate which should be charged for depreciation, it is necessary to know first of all the lifetime of the plant, or in insurance terminology, the life expectancy of school buildings. In this study an attempt will be made to find the average life of school buildings that have been actually replaced as the initial step in the determination of depreciation rate.

Project 13. A problem scale in arithmetic.—Once or twice each year during the past twelve years we have attempted to do our bit in the evaluation of scaled material by obtaining returns on verbal problems in arithmetic. We now have returns, many of them very extensive, on six or seven hundred problems. It is our intention to put this material into shape for a scale which shall be somewhat in the form of the Ayres Spelling Scale or the Hahn-Lackey Geography Scale. The scale for difficulty will be along the top of the chart, and the problems will be entered in columns below the scale. The problems will run in difficulty from those which as many as 80 or 90 percent of the upper second-grade children can do correctly to those which not more than 10 or 15 percent of the upper eighth-grade children can get right.

Project 14. The rating of teachers.—It is a fact, keenly realized by most research workers, that the lack of a reliable means of rating teachers prevents the satisfactory solution of many educational problems. Not a few people have attempted to rate teachers. In most instances, the attempt has been of dubious value. What we are interested in is the measurement of the teaching process rather than the teacher as a personality. We are interested primarily in an accurate evaluation of the teachers' instructional efforts, in order that a scientific control of the teacher and of the teacher's influence may be set up in a research experiment. It happens, however, that this is a desideratum in practical school work. We do not mean that schools are not properly interested in what the teacher is as a human being, but only that a part of the rating of a teacher in the broad sense should fail to include her community relationships. What we mean is that there are important reasons for knowing what the teacher's success is as an instructor of children.

Project 15. The work of the departments of school attendance.—Compulsory school-attendance laws have been enacted by every state in the Union. These have been reinforced by rulings of state departments of education and regulations of local boards of education. Practically every city has an attendance officer and the larger cities have attendance departments commensurate with the number of children involved. The practice, however, regarding the duties and regulations of the personnel in attendance departments is so varied that an extensive study has been undertaken. Questionnaire material has been received from a large number of cities, and this information is being supplemented by personal visits, state codes, and reports of state departments.

Project 16. The one-room rural teacher.—Ohio still has more than four thousand one-room rural schools. An accurate picture of this situation showing not only training and experience of the teacher, but the work which she has to do and the conditions under which

she works is not easily available. An effort will be made to secure the information in typical counties which will enable us to set forth clearly a large number of factors involved in the one-room situation. The whole-hearted cooperation of county superintendents and rural teachers is requested.

Project 17. A study of the repeater.—Certain studies in the past have indicated that approximately three-fourths of the children who are marked for failure make good in the succeeding grade if they are given conditional promotion. The purpose of this project is to ascertain, if possible, the important causes of repeating and the extent to which repetition is beneficial to the pupil. A careful analysis will also be made seeking to determine the particulars in which the repeater differs from his colleagues of the previous year who were not required to repeat the work of the grade. Such factors as intelligence, home environment, previous school record, attitude, extra-curricular activities, and extra-school activities will be taken into consideration.

Project 18. The training of mentally handicapped pupils in large and small centers.—Two plans in the training of mentally handicapped pupils commonly are followed: the establishment of a large number of small centers either in regular school buildings or small buildings erected for that purpose, and the plan whereby a few large centers are organized and the pupils transported to them. Where bus transportation is provided under the second plan a considerable item of additional expense is involved. The purpose of this investigation is to compare the progress and the cost of instruction of mentally handicapped pupils in large and small special school centers.

Project 19. Status of wider use of school buildings.—The trend toward the use of school buildings as community centers has greatly increased their use for other than school purposes. In different communities various practices with respect both to the amount of such use and to the conditions under which this use is permitted have grown up. The purpose of this study is to analyze certain aspects of the problem of the wider use of school buildings in a large number of communities.

Project 20. A case study in the discrepancies between success in school and results of intelligence tests.—It is a well-known fact that some children who score low on intelligence tests do well in school while others who score high failed to achieve as well as the intelligence scores would indicate that they should. By careful analysis of all facts obtainable regarding a few individuals in which such discrepancy is apparent, an effort will be made to ascertain the determining causes. Such factors as are designated under Project 17 will be considered also in a study of the individuals in Project 20.

Project 21. The effectiveness of radio as a means of instruction.—The introduction of radio in the public schools is so recent that little material has been gathered on either the extent or effectiveness of its use for instructional purposes. That it has potentialities as an educative instrument is generally conceded. In this study, an effort will be made to determine the sorts and the extent of the uses to which the radio is being put as an instructional means and to ascertain as nearly as possible the effectiveness of this use.

Project 22. A study of the progress of pupils doubly promoted.—There is a strong feeling on the part of many school people, teachers especially, that if children are given a double promotion they miss something which results in weakness in their future work. This study will undertake to ascertain the extent to which such feeling has a fundamentally sound basis. To some extent it is a companion study to Project 17 which

involves the student who makes less than regular, progress, just as this involves the one who is progressing more rapidly than normal.

Project 23. School procedures common in unified kindergarten-primary programs.—In cooperation with the Research Committee of the International Kindergarten Union, a study will be made of the actual school procedures and materials through which schools and school systems are attempting to carry out a unified program through the kindergarten and primary grades. This project is one section of a larger investigation of the status of nursery school–kindergarten–primary unification which is being sponsored by the Research Committee of the I. K. U. this year. An attempt will be made to gather information from representative public-school systems, private schools, normal schools and teachers' colleges, university laboratory and observation schools, and the practice schools of private kindergarten-primary training schools.

Project 24. Opportunities for teachers in the various fields of subject-matter.—Students preparing to teach are interested in the opportunities for election and promotion in the various subject-matter. Such information as can be collected and assembled will be made available for advising prospective teachers. This will include material relating to supply and demand in each field. Since there is continuous change in elections and standards for promotion, it is the plan of the Bureau to make such a survey at periodical intervals in order that trends may be determined and fluctuations in supply and demand anticipated.

Project 25. Optimum routes for professional advancement.—Are there optimum starting places for those looking upon teaching as a life work? Do the locality, type of work, the size of school system in which a teacher begins affect his total life income and professional advancement? In what lines does one gain in salary with a corresponding loss in permanency of tenure? Is there evidence that one gains most by moving at least once every five years, or does a long period of service in the same community bring the greatest ultimate personal advancement? Superintendents in smaller systems are frequently willing to accept appointments as principals or teachers in larger systems at a reduced salaries on the ground that the enlarged opportunities will ultimately bring professional advancement and increased earning power. It is the purpose of this project to study comparative success in different channels of education by case studies of graduates of Ohio State University.

Project 26. Evaluation of teacher training in Ohio State University.—In as much as the purpose of teacher training is to give adequate preparation to those entering the profession, it is important to ascertain the degree to which the present training of teachers is considered adequate by those under whose direction graduates of this institution are teaching. It is the purpose of this project then to secure from those administrative and supervisory officials, information as to the strong and weak points in the training of our graduates, together with suggestions for improvement. It will also include detailed questioning of graduates of this institution who have had one year of experience in order to find the difficulties they encounter as beginning teachers and suggested means by which these difficulties may be met.

Score Cards for Judging Clothing Selection and Construction are issued in pamphlet form by the United States Department of Agriculture (Miscellaneous circular No. 90). The bulletin helps to establish standards for economical, becoming, and healthful apparel. It is intended particularly as a guide in judging clothing contests.

EDUCATIONAL READINGS

DONOVAN, H. L. AND ROBERT, E. B. *A Review of Twenty-Three Sets of Elementary Readers*, PJE, 4:359–69, May, 1927.

The writers and a number of graduate students in education have critically examined twenty-three sets of elementary readers and have summarized their findings in this article. Thirteen standards were set up for use in the examination of these books, thus giving some degree of objectivity to the evaluation. Comments pertaining to each of the twenty-three sets follow the titles of the books examined.

ALEXANDER, CARTER. *How to Equip the School Administrator with Methods of Locating Data Which Will Carry Over When He Is on the Job*, TCR, 28:890–99, May, 1927.

One of the problems facing every training school is that of making the courses and work taken carry over to the actual situation. In the training of administrators three things are advocated: regular courses which frequently approximate actual field conditions; internships under experienced men who are willing to give some personal attention to the training of their internes; and a method of school surveys where the students actually face the problems in a real situation.

STURTEVANT, SARAH M., AND FLEMMING, CECILE WHITE. *Extra-Curricular Activities from the Viewpoint of the High-School Girl*, TCR, 28:884–89, May, 1927.

Girls like athletics best, but they do not feel that they benefit most from these. The activities which furnish the most pleasure combined with conscious benefits are the literary and aesthetic activities. The activities from which they feel that they receive the greatest benefits—student government and class activities—they seem to enjoy least. The personal enjoyment of the activity itself is the reason most commonly given for pleasure in it.

LEONARD, S. A., AND MOFFETT, H. Y. *Current Definition of Levels in English Usage*, EJ, 26:345–59, May, 1927.

This report represents a preliminary account of a study made under a grant from the Executive Council of the National Council of Teachers of English. The study was undertaken to find out what some two hundred judges have observed about the use or non-use by cultivated persons of one hundred and two expressions which are usually condemned by English textbooks and classes. Twenty-six of the judges were eminent linguists. The rest were members of the Modern Language Association, the English Council, and the Speech Council; business executives; authors; and editors. The detailed rankings of the linguists are given in detail in Table I and the composite rankings of the other judges in Table II. Although no decisions are made as a result of the study, some important facts relative to current usage are observable. It is interesting to note that more than forty expressions usually condemned by grammarians are accepted for informal cultivated use by more than 75 percent of the linguists.

WEBB, H. A. *The High School Science Library for 1926*, PJE, 4:351–58, May, 1927.

The author provides high-school administrators and science instructors with a classified, annotated bibliography of science books which were published in 1926. To assist further those who may be interested, the names and addresses of the publishers are given; also, the titles of the books have been arranged in five price groups ranging from ten dollars to one hundred dollars and more. Each price group includes those books which are "recommended as having the best quality and variety" for the respective groups. This library list of science books is a continuation of similar lists which have appeared for previous years.

KNIGHT, F. B. *Possibilities of Objective Techniques in Supervision*, JER, 16:1–15, June, 1927.

Dr. Knight suggests seven "tools" which may be used in objective supervision. These tools are: weekly inventory drills, teacher's diagnostic record, teacher's weekly report to supervisor, supervisor's control chart, supervisor's weekly report to teachers, diagnostic tests, remedial units, and the text (course of study) revised through weekly inventory drills and diagnostic tests. As one who is familiar with the author's work would suspect, he illustrates how these tools may be used by citing problem cases in arithmetic and stating which tools apply to each case.

FRYER, DOUGLAS. *Interest and Ability in Educational Guidance*, JER, 16:27–39, June, 1927.

Are interest and ability closely enough related to enable us to predict accurately one from the other? Thorndike, on the basis of two studies which he made and his evaluation of a study made by Bridges and Dollinger, "contends that interest is highly predictive of ability." Dr. Fryer, maintaining that prediction on the correlation which Thorndike obtained "is a risky basis," proceeded to conduct other experiments to test Thorndike's

NOTE.—The abbreviations used in this number are: *PJE*, Peabody Journal of Education; *TCR*, Teachers College Record; *EJ*, English Journal; and *JER*, Journal of Educational Research.

method and contention. As a result of data obtained from 104 University of Utah students and 89 New York University students, particularly from the latter, the writer concludes that, while "interest is suggestive of ability, the evidence indicates emphatically that the relationship between them is not such that one can accurately predict one from the other."

DOLCH, EDWARD WILLIAM. *Grade Vocabularies*, *JER*, 16:16–26, June, 1927.

Vocabulary studies of various sorts are rather numerous. This is perhaps chiefly due to two reasons, the great value they possess and the relative ease of securing objective data. The one which Dr. Dolch reports was planned to learn what words children know as they progress from Grades II through VIII. It differs from previous vocabulary studies particularly in the method of securing the words—the 16,206 children who participated were asked to write all the words they could think of in fifteen minutes. Using Thorndike's rules for recording word forms, 12,622 different words were procured from the 2,312,000 running words submitted. About one-fourth of the 9,583 words which appeared more than once are found in no other study.

IN PAPER COVERS

ENGELHARDT, FRED. *Survey Report of Albert Lea Public Schools*. Minneapolis, Minnesota: University of Minnesota, 1927. 61 pp. (Bulletin of University of Minnesota: Educational Monograph No. 14)

In the development of the housing needs of the public schools of Albert Lea, Minnesota, the general survey plan of approach wherein population, school organization, school plant, and finances are analyzed, has been followed. The report recommends that, on account of the size of the city, the present mid-year promotion plan be replaced by annual promotions; that the 8–4 plan be replaced by the 6–3–3 plan; and that, in order to have available data to check the building recommendations, a continuous census be set up.

BUCHANAN, MILTON A. *A Graded Spanish Word Book*. Toronto, Canada, The University of Toronto Press, 1927. 195 pp. (Publications of the American and Canadian Committees on Modern Languages, Vol. III)

A word count of 1,200,000 running words found in seven major types of Spanish literature was made to determine those words most often used in written Spanish and those words which have the widest range of use, as found in the seven forms of writing examined. The monograph contains 6,702 words which occurred ten times, or less than ten times but in at least five categories or types of writing. These words are arranged by order of merit and also alphabetically, with frequency, range, and merit numbers. This publication is similar in make-up to Thorndike's *Teacher's Word Book*.

RESEARCH STUDIES IN COMMERCIAL EDUCATION. Iowa City, Iowa, University of Iowa, 1926. 160 pp. (University of Iowa Monographs in Education, First Series, No. 7)

The State University of Iowa sponsored, in 1926, the first of a series of annual conferences on commercial education. This is the first conference ever held which was devoted entirely to research in commercial education. The monograph has been published in order that the sixteen investigations reported at the conference may be made available in permanent form to all who are interested in this phase of educational activity. Each address is printed in full. Those persons who are in any way responsible for the direction of commercial education should become acquainted with the material presented in the monograph.

GRANT, G. A. *Introduction to the Teaching of Industrial Arts in Secondary Schools*. New York, Teachers College Bureau of Publications, Columbia University, 1926. vii + 60 pp. (Teachers College Syllabi, No. 13)

The author says in the Preface "The following material is organized to suggest the basis of an activity program for secondary school Industrial Arts teachers." The material consists of sixteen case problems. A list of reading references on each of these problems is given. The last twenty-six pages of the syllabus present an extensive "collected bibliography" on the industrial and practical arts. Instructors who have students preparing to become industrial arts teachers should find this syllabus a helpful guide in the organization of their courses.

Survey Report of the Schools of Fort Lee, New Jersey. New York, Teachers College, Columbia University, 1927. 136 pp. (Institute of Educational Research, Division of Field Studies, Teachers College, Columbia University, School Survey Series)

This survey report of the schools of Fort Lee, New Jersey, includes a detailed analysis of the administrative, housing, and instructional aspects of the school problems of the city together with specific recommendations governing each of these major fields. Pupil achievement, classification, teaching staff, extra-curricular activities, courses of study, and time allotments are analyzed. The concluding chapter of the report deals with "Relations with the Public" in which recommendations are made for the organization of an informational program under the direction of the Board of Education. In view of the fact that in most communities there is no organized effort to keep the public informed as to educational activities, this recommendation seems significant.

BOOKS TO READ

REAVIS, WILLIAM CLAUDE. *Pupil Adjustment in Junior and Senior High Schools.* Boston, D. C. Heath and Company, 1926. xviii+248 pp.

This book, the contents of which can be read in a short time, presents a picture of what scientific education—as practiced in the University of Chicago High School—means to the individual child as compared with the mass education so prevalent in our public high schools. The book should be read by all who are interested in our educational progress.

SPAULDING, FRANCIS T. *The Small Junior High School.* Cambridge, Massachusetts, Harvard University Press, 1927. xvi + 226 pp.

Dr. Spaulding has made a careful analysis of nineteen junior high schools in Massachusetts, none of which enrolls more than 160 students. Forty pages of his book are devoted to a critical appraisal of the "limitations and possibilities" of schools of this type. Superintendents, principals, and teachers who are charged with the direction of small junior high schools will find the numerous suggestions contained in this book to be helpful. A rather complete bibliography increases the value of the book to students of education.

BEGTRUP, HOLGER, LUND, HANS, AND MANNICHE' PETER. *The Folk High Schools of Denmark and the Development of a Farming Community.* London, Oxford University Press, 1926. 168 pp.

This is an inspiring and stimulating little book describing the Danish folk high schools. Book I traces the rise of the peasants out of their condition as an underclass, at the beginning of the nineteenth century, to their present status as "a well-to-do middle class which, politically and socially, now takes the lead among the Danish people." It shows, moreover, in what ways the high schools functioned to produce leaders and to equip the people with the knowledge and enthusiasm requisite for transforming their economic and political status. Book II discusses the character of the instruction and the curriculum of the schools, and sketches the lives of the leaders in the folk high-school movement.

STREITZ, RUTH. *Safety Education in the Elementary School.* New York, National Bureau of Casualty and Surety Underwriters, 1926. vii + 142 pp.

Miss Streitz undertook to determine the common hazards of today, the subject-matter and materials which may be taught effectively, and the sources from which such materials may be drawn. She secured her data from questionnaire returns from city superintendents, from analyses of courses of study and courses in accepted school subjects, and by observations of the teaching in three school systems. She has presented clearly and precisely the safety problems which confront our children and has organized the specific objectives through an examination of the pupil's own experience with accidents, the statistical reports of accidents within the school districts studied, and the objectives located in courses offered in schools and in subject-matter texts.

On the basis of all these findings, Miss Streitz has organized a proposed course of study in safety education by grades for the entire elementary school. Each grade sets forth certain objectives, provides the knowledges and habits which need to be provided during this period. There is a vast amount of information indicated in this course, much of which would have to be secured by the teacher or by the pupils under the teacher's direction in the local situation. While there is a definite effort to provide pupil activities, there is a large amount of material given which simply does not lend itself to other than knowledge acquisition. It represents a good effort in a field in which thought is far from crystallized and material widely scattered.

ANALYSES OF THREE THOUSAND ILLEGIBILITIES IN THE HANDWRITING OF CHILDREN AND OF ADULTS

(*Continued from page 273*)

SUMMARY

From this detailed analysis of factors interfering with the legibility of the handwriting of students from the third grade to college level, several facts were formulated:

1. Twenty different general characteristics which interfered with legibility were found and were noted 284 times. Three hundred twenty-nine different malformations of letters appeared a total of 2,736 times.
2. Of these 2,736 illegibilities, 12 percent involved the letter *r*. The seven letters, *r*, *n*, *e*, *a*, *o*, *s*, and *t* accounted for over half of these difficulties in reading. Five malformations (*n* like *u*, *r* like *i*, *e* closed, *d* like *cl*, *c* like *a*), accounted for one quarter of these difficulties.

NEW TESTS

The Orleans-Solomon Prognosis Test has been developed for the purpose of foretelling the pupils' probable success in the study of Latin. Three short trial lessons are given, and the pupils are tested for immediate learning of these lessons. The results correlate highly with later success in Latin. The World Book Company publishes the test.

An achievement test in plane geometry is in preparation by Miss Maude McMindes, principal of the Senior High School, Hays, Kansas. The printed form is labeled "for experimental use only," so that the test is not ready for general distribution.

The Ely-King Tests in American History are a series of seven tests covering various periods in American history. The authors of the test have also developed a teachers' manual and also a pupils' study guide using the problem method. These may be obtained through the Harr Wagner Publishing Company, of San Francisco.

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The Contreras-Broom-Kaulfers Spanish Silent Reading Test appears to be one of the best Spanish reading tests thus far published. Its time limit of 22 minutes makes it a test of but one aspect of reading ability, and that the most dubious. Eight minutes would show a truer score of real reading ability. It is "speed of correct comprehension" which modern movements in teaching silent reading would train. The day of the old translation by plodding, dictionary-at-the-elbow, "mere comprehension," inefficiency is discredited.

A student knowing three or four words of paragraphs 1, 3, 5, 6, 7, 8, 9, 11, 12, 14, 17, 18, 19, might be able to score correctly without understanding or sometimes even reading the balance. Paragraph 4 involves mathematical reasoning rather than ordinary reading ability. Answering paragraphs 1, 6, 8, 9, 10, 16, may be dependent on whether the student has the score word in his active vocabulary rather than showing how well he comprehends. Paragraph 6 is a typical charade or puzzle type. Paragraphs 13, 15, 18, 20, might under certain interpretations be answered with various of the key words given. Textual words, as keys in 3, 5, 7, 14, 17, 19, allow the possibility of the answer being something else besides an indication of comprehension.

Though objectionable, since they involve active vocabulary or a test of knowledge, the reviewer holds paragraphs 2, 9, 10, 16 to be most logically developed from beginning to end so as to serve as a unit in testing comprehension. G. O. R.

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The reviewer would be inclined to designate the Contreras-Broom-Kaulfers Spanish Vocabulary Test as an *association* rather than a *vocabulary test*. If it were really a vocabulary test it should show what it purports to: "the extent of an individual's Spanish vocabulary." But it would fail miserably in our numerous schools where pupils have limited English but extensive Spanish vocabularies.

Actual administration of these tests shows what anybody knows is not true, for example, that many a second-year American student has a better Spanish vocabulary than that of the Spaniard himself.

It is most unfortunate that the authors failed to work out a technique which like the reading test would get around this seriously invalidating factor. Their technique is even more objectionable than most others, because the puzzle element makes it essentially and *intelligence test*. G. O. R.